

CLAIMS

1. A method for planning a telecommunication network for radio apparatuses including a plurality of cells
5 distributed over a geographical area, each of which comprises a set of elementary areas of territory (pixels) ($p_{m,n}$) adapted to receive a radio signal irradiated by a fixed radio base station (SRB), the method including for each cell the determination of a service area comprising
10 the location of the pixels of territory ($p_{m,n}$) of the cell in which the network, on the basis of a pre-set limit value (η_{lim}) of a cell load factor (η), is able to provide predetermined services to the mobile apparatuses located therein,

15 characterised in that it comprises the steps of:

- identifying the pixels of territory ($p_{m,n}$) belonging to the service area pertaining to a pre-set cell according to a criterion for selection in succession based on the values of a sorting function ($R_{m,n}$) which is a function of
20 at least the quantity of traffic ($T_{m,n}$) pertaining to the pixel of territory being examined; and
- computing the service area as a set of the pixels of territory ($p_{m,n}$) of the cell that are in succession selected so that the sum of the contributions due to each
25 pixel of territory ($p_{m,n}$) does not exceed the pre-set limit value (η_{lim}) of the cell load factor (η).

2. A method as claimed in claim 1, characterised in that said sorting function is a function ($R_{m,n}$) of the value of
30 electromagnetic attenuation ($a_{m,n}$) between the fixed Radio Base Station (SRB) of the pre-set cell and the pixel of territory ($p_{m,n}$) being examined, and of the quantity of

traffic ($T_{m,n}$) pertaining to the pixel of territory ($p_{m,n}$) being examined.

3. A method as claimed in claim 1 or 2, comprising a
5 further step (340) of computing macro-diversity areas in which, for each service area previously calculated (320), a verification is made as to whether the pixels ($p_{m,n}$) outside said area, but in which the signal irradiated by the fixed Radio Base station (RBS) is received with a
10 power exceeding a predetermined threshold can be served by radio base stations (RBS) of adjacent cells.

4. A method as claimed in any of the previous claims, comprising a further step (400) of determining the areas
15 in unavailability or outage conditions, by considering pixels of territory ($p_{m,n}$) belonging to the service area according to a criterion for selection in succession determined by said sorting function ($R_{m,n}$).

20 5. A method as claimed in any of the previous claims, characterised in that the pixels of territory ($p_{m,n}$) belonging to the service areas are selected starting from the location of the pixels in which the signal irradiated by the fixed station (RBS) is received by a mobile
25 apparatus with a power exceeding a predetermined threshold in such a way that it can be recognised and decoded.

6. A method as claimed in any of the previous claims, characterised in that the information about traffic
30 distribution over the territory are computed starting from a plurality of predetermined values of traffic offered for each service per pixel ($T_{m,n,i}$) according to a relationship

which, for each pixel, assigns a corresponding value of equivalent traffic ($T_{m,n}$) as a function of variables that are representative of the characteristics of the radio connection.

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7. A method as claimed in claim 6, characterised in that the value of equivalent traffic ($T_{m,n}$) for one pixel of territory is computed according to the relationship:

$$T_{m,n} = \frac{1}{B_0} \sum_{i=0}^{S-1} B_i \cdot T_{m,n,i}$$

10 where:

S is the total number of services, B_0 is the Bit rate of the service at the lowest speed, B_i is the Bit Rate of the i^{th} service present in the pixel m,n and $T_{m,n,i}$ is the traffic offered in the pixel m,n for the i^{th} service.

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8. A method as claimed in claim 6 or 7, characterised in that said sorting function ($R_{m,n}$) is a function that is directly proportional to the value of electromagnetic attenuation ($a_{m,n}$) of the pixel ($p_{m,n}$) and inversely
20 proportional to the quantity of traffic ($T_{m,n}$) of the pixel ($p_{m,n}$), according to the formula:

$$R_{m,n} = \frac{a_{m,n}}{T_{m,n}}$$

where:

$a_{m,n}$ is the attenuation between pixel m,n and radio base
25 station and $T_{m,n}$ is the equivalent traffic of the pixel m,n and in that the selection of the pixels of territory ($p_{m,n}$) belonging to the service area takes place according to a succession determined by the increasing values of said function ($R_{m,n}$).

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9. A method as claimed in claim 6 or 7, characterised in that said sorting function ($R_{m,n}$) is expressed according to the formula:

$$R_{m,n} = \sqrt{\left[\left(\frac{T_{m,n}}{T_{p,q}^{Max}}\right)^2 + \left(\frac{a_{m,n}}{a_{i,j}^{Max}}\right)^2\right]}$$

5 where:

$a_{m,n}$ is the attenuation between pixel m,n and radio base station and $T_{m,n}$ is the equivalent traffic of the pixel m,n the values of attenuation ($a_{m,n}$) and of equivalent traffic ($T_{m,n}$) per pixel being normalised to the maximum value of
10 equivalent traffic and to the maximum value of attenuation of the cell.

10. A method as claimed in claim 6 or 7, characterised in that said sorting function ($R_{m,n}$) is expressed according to
15 the formula:

$$R_{m,n} = \left| \frac{T_{m,n}}{T_{p,q}^{Max}} \right|$$

where:

$T_{m,n}$ is the equivalent traffic of the pixel m,n normalised to the maximum value of equivalent traffic of the cell.

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11. A method as claimed in any of the previous claims, wherein the load factor (η) of a cell is defined as the ratio between a predetermined acceptable load of the cell and the maximum load in correspondence with which
25 instability arises, according to the relationship

$$\eta = \sum_{i=1}^S n_i \cdot SAF_i \cdot (1 + f_i) \cdot SNR_i$$

where:

S is the total number of services;

n_i is the maximum number of users simultaneously active in the cell for the i^{th} service;

SAF_i is the Service Activity Factor of the i^{th} service;

f_i is the ratio between intracell interference and
5 intercell interference; and

SNR_i is the signal/noise ratio for the i^{th} service.

12. A computing system (10) for planning a telecommunication network for radio apparatuses,
10 programmed to implement a method as claimed in any of the claims 1 through 11.

13. Radio network planned using the method as described in claims 1 through 11.

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14. Computer program product or group of computer program products executable by at least one computing system (10), comprising one or more modules of code for the implementation of a method for planning a
20 telecommunication network for radio apparatuses as claimed in any of the claims 1 through 11.